Commercial Crew Program Status

NAC
Commercial Space Committee

Ed Mango

Commercial Crew Program Objectives

Commercial LEO Capability

- Public Purpose
  - Competed, funded SAAs to advance industry CTS capabilities

ISS Design Reference Mission

- NASA Need
  - NASA certification contracts
  - ISS services contract

CCiCap Overview

Summary of CCiCAP Portfolio

- Diversity of spacecraft types and launch vehicles
  - Two basic types of spacecraft
    - Capsules and lifting body
  - Two different launch vehicles
    - Falcon 9 and Atlas V
- The portfolio of companies maintains competition for future phases of the program which should produce “best value” for the government
- Significant progress planned for the base period with analysis, integrated design, development, and hardware testing
- Total set of milestones provide insight into the cost and schedule required to achieve a crewed demonstration flight to low Earth orbit

Sierra Nevada Corporation

- Descriptions & Features
  - Dream Chaser spacecraft is a reusable, piloted, lifting body, derived from NASA HL-20 concept
    - Carries up to 7 crew members
    - Utilizes non-toxic propellants
    - Primary Launch Site: Cape Canaveral, Florida
    - Primary Landing Site: Shuttle Landing Facility, Florida
    - Abort scenario leverages primary propulsion system with an ability to abort to a runway landing
  - Atlas V vehicle launched from the Space Launch Complex 41 launch pad
- Base Period
  - $212.5M total NASA funding for 9 milestones
  - Significant progress toward completion of critical design
  - Two major safety reviews and significant subsystem technology maturation and hardware testing

Artist rendition of Dream Chaser in low-Earth orbit

Artist rendition of Dream Chaser and Atlas V on launch pad

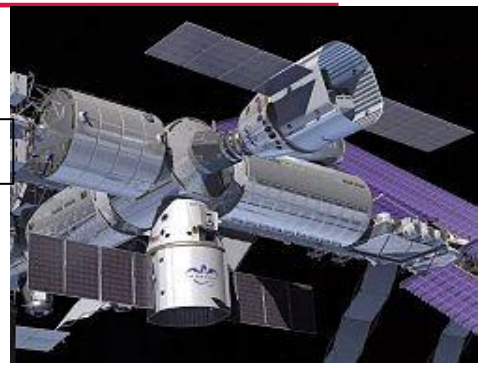
Artist rendition of Dream Chaser landing on a runway

Sierra Nevada Corporation

- Base Period Details (Key Milestones)
  - Design and Development:
    - Program Implementation
    - Integrated System Baseline Review
    - Two Integrated System Safety Analysis
    - Certification Plan
  - Testing:
    - Engineering Test Article Flight(s)
    - Wind Tunnel Risk Reduction
    - Spacecraft Subsystem Risk Reduction
    - Main Propulsion Risk Reduction
    - Reaction Control System Risk Reduction

Space Exploration Technologies Corporation (SpaceX)

- Descriptions & Features
  - Spacecraft uses a crewed version of the SpaceX Dragon capsule
    - Carries up to 7 crew members
    - Primary Launch Site: Cape Canaveral, Florida
    - Primary Landing Site: “On land” landing, specific landing site in work
    - Integrated, side-mounted launch abort system utilizing SuperDraco engines
  - Upgraded Falcon 9 vehicle launched from the Space Launch Complex 40 launch pad
  - Mid calendar year 2015 crewed test flight (dependent on funding and technical progress)



Artist rendition of Dragon attached to ISS

Artist rendition of Dragon re-entering Earth’s atmosphere

- Base Period
  - $440M total NASA funding for 14 milestones
  - Culminates in an integrated critical design review milestone
  - Includes a pad abort test and an in-flight abort test

Picture of Falcon 9 rocket on launch pad in Florida

Space Exploration Technologies Corporation (SpaceX)

- Base Period Details (Key Milestones)
  - Design and Development:
    - Integrated System Requirements Review
    - Ground Systems & Ascent Preliminary Design Review
    - Test Reviews for Pad Abort & In-Flight Abort
    - Human Certification Plan Review
    - On-Orbit & Entry Preliminary Design Review
    - Safety Review
    - Flight Review of Upgraded Falcon 9
    - Integrated Critical Design Review
  - Testing:
    - Dragon Primary Structure Qualification
  - Flight tests:
    - Pad Abort (SLC 40 and last quarter of 2013)
    - In-Flight Abort (SLC 40 and 2nd quarter of 2014)

The Boeing Company

- Descriptions & Features
  - CST-100 spacecraft is a reusable capsule design utilizing many proven flight components
    - Carries up to 7 crew members
    - Primary Launch Site: Cape Canaveral, Florida
    - Primary Landing Site: “On Land” landing, specific landing site in work
    - “Pusher” launch abort system
  - Atlas V launch vehicle using the dual engine Centaur upper stage configuration and launched from the Space Launch Complex 41 launch pad
  - Late calendar year 2016 crewed test flight (dependent on funding and technical progress)
- Base period
  - $460M total NASA funding for 19 milestones
  - Culminates in an integrated critical design review milestone
  - Significant propulsion system, avionics, and wind tunnel development and testing

Artist rendition of the CST-100 spacecraft

Artist rendition of CST-100 and Atlas V on the launch pad

Successful parachute drop test accomplished during CCDev2

The Boeing Company

- Base Period Details (Key Milestones)
  - Design and Development:
    - Integrated System Review
    - Production Design
    - Phase 1 Safety Review Board
    - Landing & Recovery/Ground Communication Design
    - Launch Vehicle Adapter Design
    - Certification Plan Review
    - SW Critical Design Review
    - System Critical Design Review
  - Testing:
    - Integrated Stack Force & Moment Wind Tunnel
    - Dual Engine Centaur Development
    - Orbital Maneuvering & Attitude Control Engine Development
    - Mission Control Center Interface Demonstration
    - Emergency Detection System Standalone
    - Avionics SW Integration Lab Multi-String Demonstration
    - Pilot-in-the-Loop Demonstration

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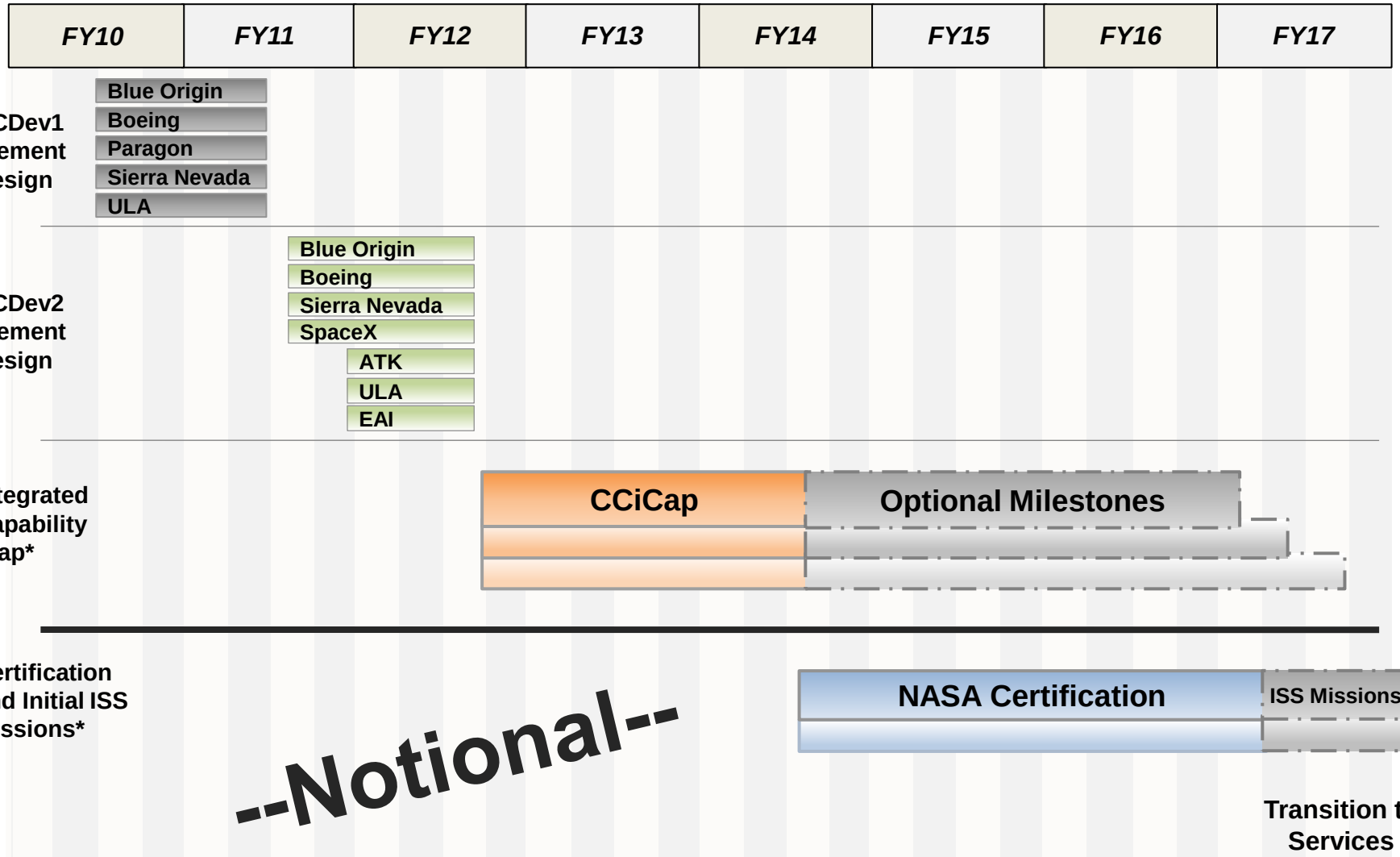
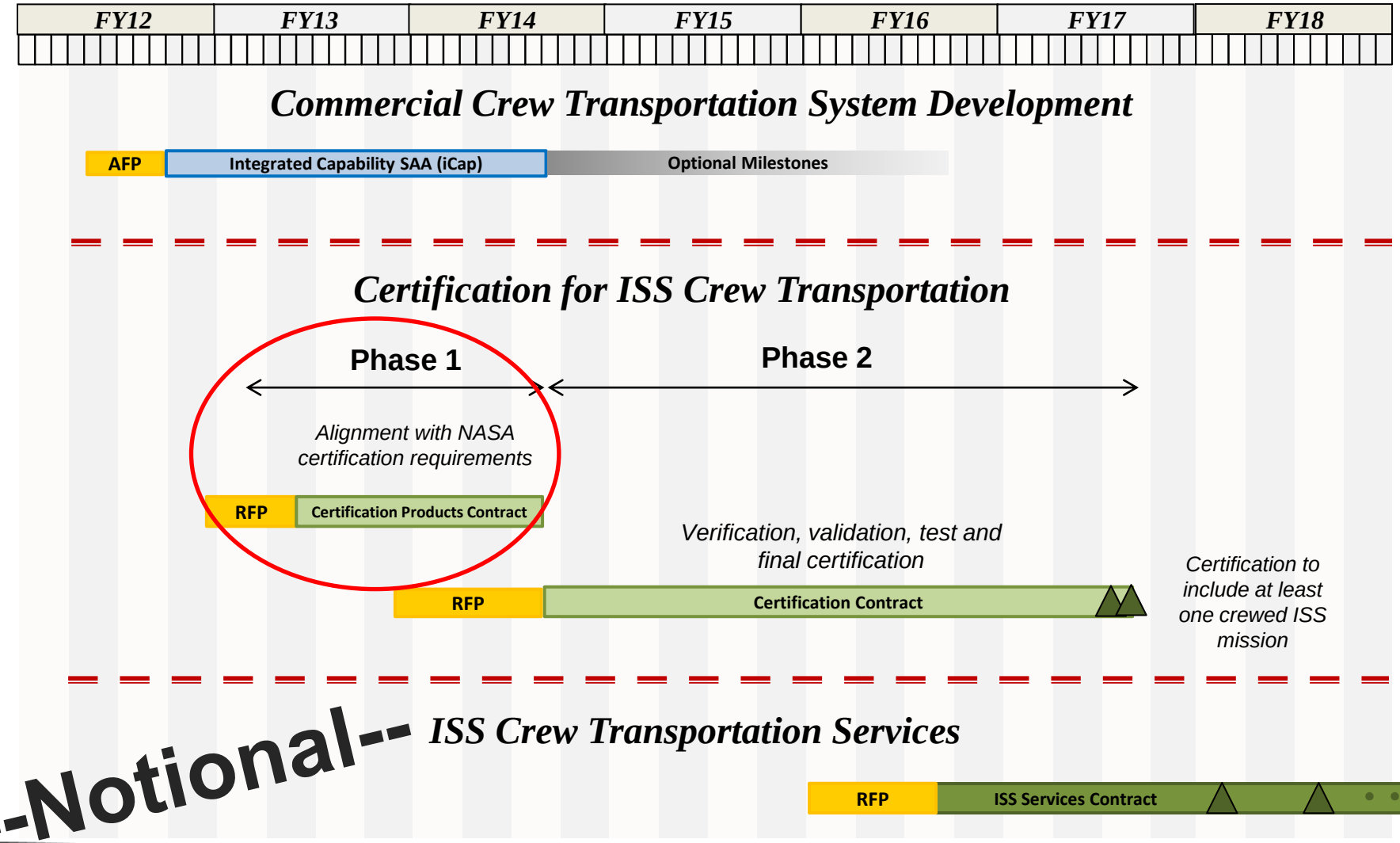
NASA/ISS Certification Overview

Presented at Program Forum in February 2012



*Number of awards to conform to budget

Revised Acquisition Strategy (2012)



Phase 1 – Certification Products Contracts (CPC)

- Contract Objective - Begin early, critical certification work to meet NASA Crew Transportation System (CTS) requirements
  - Maturing key certification products in Phase 1 enables industry readiness and level of maturity required for NASA evaluation of Phase 2
    - Allows technical interchanges between NASA and contractors on certification requirements
    - Alternate Standards
    - Hazard Analyses/Reports
    - Verification & Validation Plan
    - Certification Plan
  - Begin the process of ISS visiting vehicle integration
  - No design/development work funded through CPC
  - Increases confidence in ISS services date

Phase 2 – Certification Contract

- Contract Objective – Enabling NASA to assess and approve the CTS capability to perform the NASA ISS DRM
- Completion of key products required for the NASA crewed mission to the ISS
  - Ensure NASA mission and safety objectives are achieved
  - Activities include:
    - Development
    - Test
    - Evaluation
    - Certification
  - Options may include a nominal number of crewed missions to the ISS following successful CTS Certification
  - Phase 2 activities will lead to a competitive acquisition for commercial ISS transportation services using a FAR-based fixed price contract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http://commercialcrew.nasa.gov